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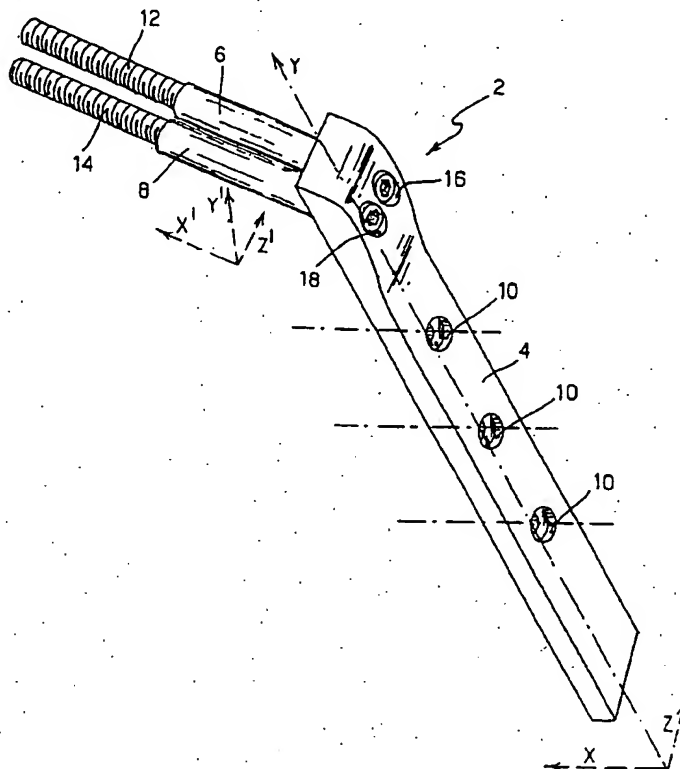
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[Continued on next page]

(54) Title: OSTEOSYNTHESIS DEVICE FOR FEMORAL FRACTURES



(57) Abstract: An osteosynthesis device (2) for fractures in the femur head is provided with an elongate plate (4) and with a pair of sleeves projecting from the upper end of the plate towards the interior of the femur head, said sleeves being placed horizontally side by side on a plane (X'-Z') perpendicular to a vertical centre plane (X-Y) of the plate (4), so as to allow a very wide bearing surface in the vertical direction and simultaneously allow an excellent resistance to torsion.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## OSTEOSYNTHESIS DEVICE FOR FEMORAL FRACTURES

The present invention relates to an osteosynthesis device for fractures in the head of an elongate bone.

5 More particularly, the invention relates to a system with a plate and screws allowing to immobilise one or more fractures in the head of a bone of elongate type, such as a femur.

The plates generally have an elongate shape and are available in different models, depending on the shape and size of the bone  
10 they are to be applied to.

A plurality of independent screws, directly screwed into the bone by means of suitable tools, are generally used for fixing a plate to a bone and for immobilising the fracture.

At least a projecting sleeve is generally present in the upper  
15 terminal part of the plate. Said sleeve is able to penetrate into the femur head, into which a corresponding compression screw is inserted.

Although the solution of using one single screw is the simplest one, it can cause some inconvenience. In fact, the femur head is  
20 subjected to considerable stresses, especially of torsional type, that can open the fracture, thereby jeopardising a perfect setting.

In order to get round this inconvenience, the tendency is to use plates provided with two parallel sleeves, and therefore two screws, like for instance the plate shown in the European patent  
25 application EP 0 649 635.

In fact, the document EP 0 649 635 describes a plate for osteosynthesis provided in its upper part with two parallel sleeves, vertically placed side by side, that is longitudinally to the same plate. However, even if this solution allows to avert the torsional  
30 movements of the fractured part of the femur, it offers a rather limited bearing surface in the vertical direction.

In fact, the femur head must support a large part of the person's weight, and this weight turns out to be a force vertically applied on the sleeves and on the screws.

Therefore it appears clear that the plate shown in the document EP 0 649 635 offers a bearing surface in the vertical direction limited to the width of the sleeve and of the upper screw, the second sleeve and the second screw being hidden underneath.

It is an object of the invention to provide an osteosynthesis device for fractures in a femur head, said device being provided with a pair of sleeves for the insertion of two corresponding screws, offering a very wide bearing surface in the vertical direction and simultaneously assuring an excellent resistance to torsion.

The above and other objects are achieved by means of the device made in accordance with the invention, as claimed in the hereby attached claims.

The device, made in accordance with the invention, provides for the presence of at least two sleeves horizontally placed side by side, each sleeve being suitable to house a corresponding screw.

The above and other objects of the invention will become more readily apparent from the following description of a preferred embodiment, with reference to the accompanying drawings, in which:

- Figure 1 is a perspective view of a first embodiment of an osteosynthesis device made in accordance with the present invention;
- Figure 2 is a perspective view of a second embodiment of an osteosynthesis device made in accordance with the present invention;
- Figure 3 is a side perspective view of a third embodiment of an osteosynthesis device made in accordance with the present invention; and

- Figure 4 is a frontal view of the osteosynthesis device of Figure 3.

Referring to Figure 1, an osteosynthesis device 2 for immobilising a fracture in a femur head comprises a plate 4 provided with a plurality of holes 10 for the fixing, by means of suitable screws, to the elongate part of a femur. Said device further comprises a pair of sleeves 6,8 arranged in correspondence with the upper end of the plate 4 and projecting towards the interior of the femur head for the insertion, through two holes 16,18, of a pair of screws 12,14.

The two sleeves 6,8 penetrate into the bone over all their length, while the plate 4 rests on the external surface of the bone.

The two sleeves 6,8 are horizontally placed side by side and lie on a plane X'-Z' substantially perpendicular to a vertical centre plane X-Y of the plate 4. Thanks to this particular configuration, the sleeves 6, 8 and the corresponding screws 12, 14 offer a very wide bearing surface in the vertical direction.

The size of the sleeves 6, 8, in particular their length and diameter, can be varied for manufacturing different models of osteosynthesis devices or for adapting said sleeves to different types of compression screws.

In fact, in the device 2 of Figure 1 where the two compression screws 12, 14 are shown in a schematic way, it is possible to use different types of screws, in so far as the used sleeves allow.

A second embodiment of an osteosynthesis device 20 made according to the present invention is shown in Figure 2.

The device 20 of Figure 2 is provided with an elongate plate 24, provided with holes 30 for the fixing to the bone by means of suitable screws, said plate having a shape and characteristics similar to the plate 4 of the 2 previously described.

The device 20 differentiates from the device 2 because the two

sleeves 26, 28, arranged at the upper end of the plate 24 in correspondence with two holes 36, 38 and projecting towards the interior of the bone, present between them a diverging angle  $\alpha$ .

This configuration of the sleeves allows to improve the grip of the screws into the bone and, in any case, offers a very wide bearing surface in the vertical direction.

Likewise the sleeves 6, 8 of the device previously described with reference to the Figure 1, the two sleeves 26, 28 lie on a plane substantially perpendicular to a vertical centre plane of the plate 24.

The angle  $\alpha$  may vary between zero and a few degrees, according to the type of bone and to the length of the screws 32, 34 used.

A second embodiment of the osteosynthesis device 40 manufactured according to the present invention is shown in the Figures 3 and 4.

The device of Figure 3, shown in a side view when applied to a fractured femur 62, is provided with an elongate plate 44, provided with holes 62 for the fixing to the bone by means of suitable screws 64, said plate having a shape and characteristics similar to the plate of the device 2 previously described with reference to Figure 1. Said device is further provided with three sleeves 42, 46, 48 projecting from the upper end of the plate towards the interior of the bone.

The device 40 differentiates from the device 2 described with reference to the Figure 1 because it is provided with a third sleeve 42, arranged in a central position above the sleeves 46 and 48.

The two lower sleeves 46 and 48 are parallel between them, but they could also diverge, and lie on a plane substantially perpendicular to a vertical centre plane of the plate 44, likewise the sleeves 6, 8 of the device previously described with reference to the Figure 1.

Instead, the third sleeve 42 lies on a plane parallel to the plane on which the lower sleeves 46 and 48 lie and is parallel to said sleeves.

The Figure 4 shows the device 40 of Figure 3 in a frontal view  
5 without the screws for the fixing to the bone.

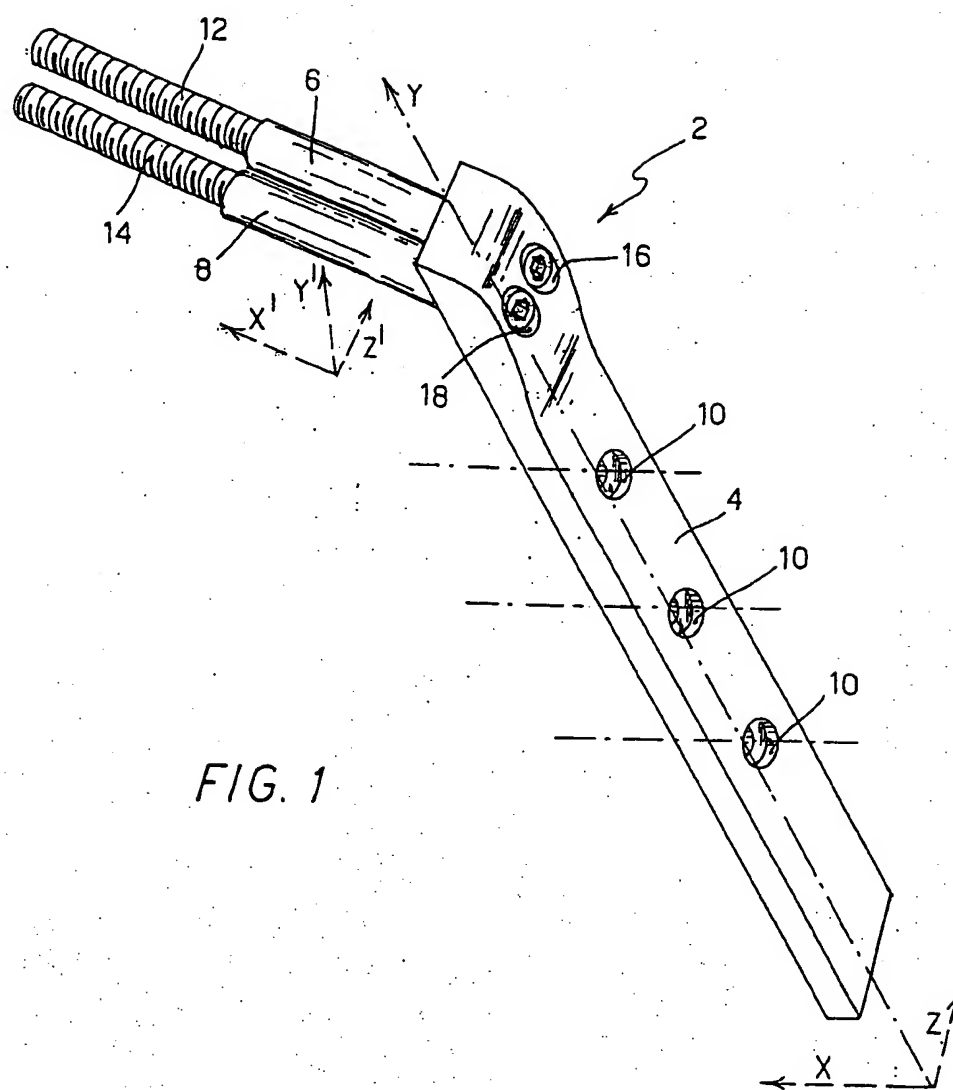
The sleeves shown in the Figures from 1 to 4 are manufactured in a unique body with the plate, for instance in stainless steel or in another biocompatible material. As an alternative, the plate and the sleeves could be manufactured as separate pieces that can be  
10 joined for instance by screwing the sleeves in threaded holes obtained in the plate. The latter solution would have the advantage of allowing the combination of different types of sleeves, having different lengths or internal diameters, with different types of plate.

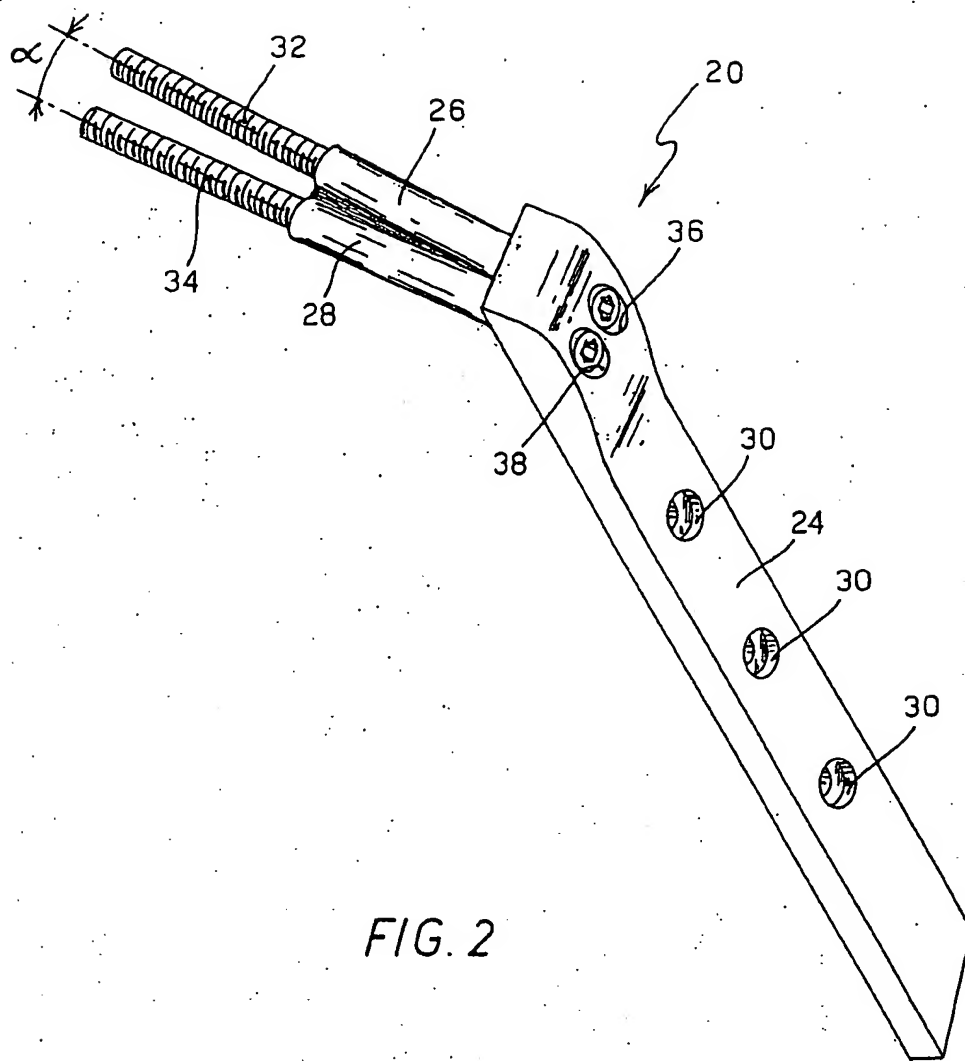
**Patent claims**

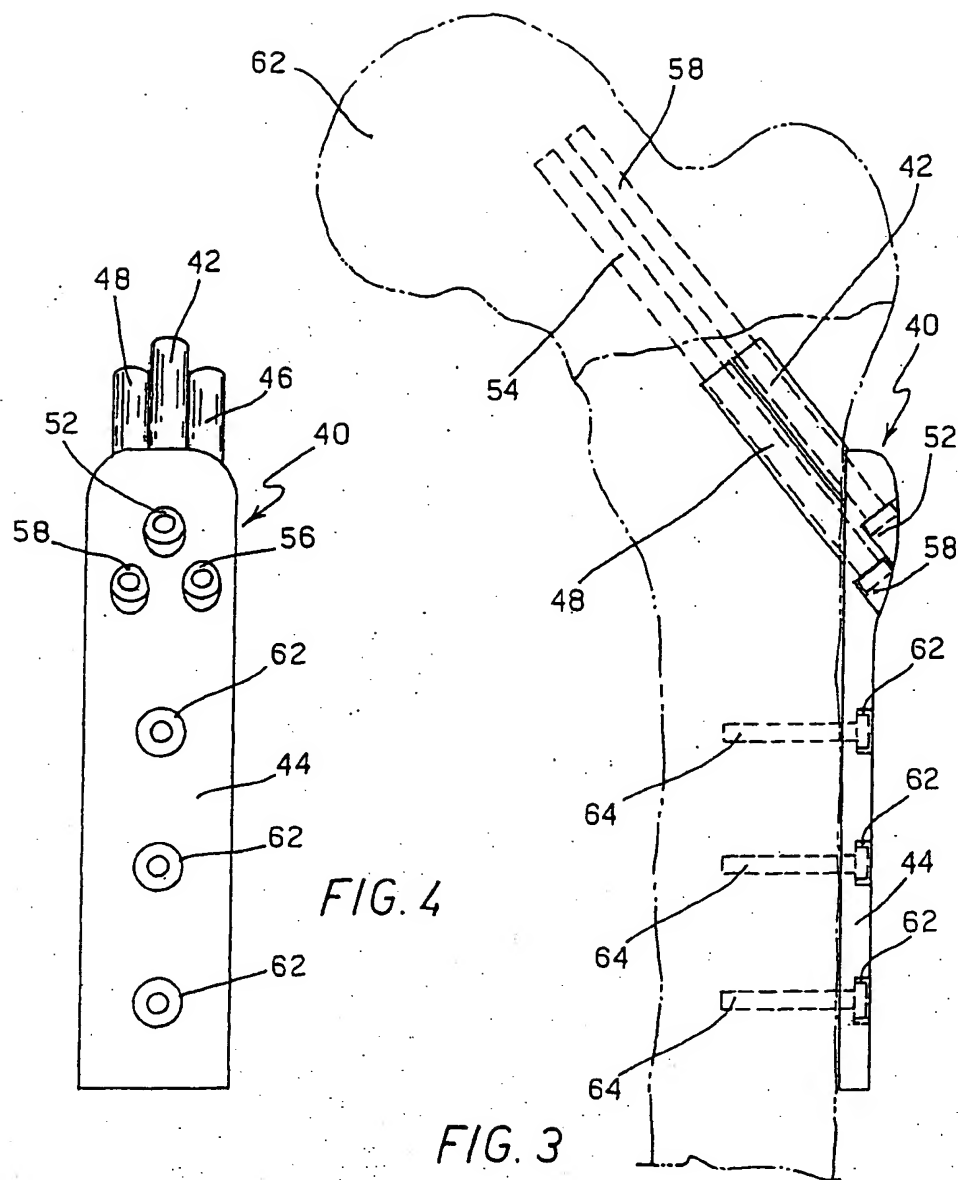
1. An osteosynthesis device (2; 20; 40) for fractures in the head of an elongate bone (62), of the type comprising:
  - a plate (4; 24; 44) having a plurality of holes (10, 16, 18, 30, 36, 38; 62, 52, 56, 58) for fixing said plate to said femur;
  - at least two sleeves (6, 8; 26, 28; 46, 48), projecting from said plate in the bone direction and internally hollow, said at least two sleeves being arranged in correspondence with two corresponding holes (16, 18; 36, 38; 56, 58) obtained in said plate and being adapted to receive a compression screw (12, 14; 32, 34; 54) suitable to be screwed into the head of said femur (62);
- characterised in that said at least two sleeves (6, 8; 26, 28; 46, 48) are horizontally placed side by side and lie on a plane (X'-Z') substantially perpendicular to a vertical centre plane (X-Y) of said plate (4; 24; 44).
2. Device according to claim 1, wherein said at least two sleeves (6, 8) are parallel between them.
3. Device according to claim 1, wherein said at least two sleeves (26, 28) are divergent between them.
4. Device according to claim 1, further comprising a third sleeve (42) arranged above said at least two sleeves (46, 48) in a central position.
5. Device according to claim 4, wherein said third sleeve (42) is parallel to the plane where said at least two sleeves (46, 48) lie.
6. Device according to claim 5, wherein said third sleeve (42) is parallel to said at least two sleeves (46, 48).
7. Device according to any of the preceding claims, wherein said sleeves are manufactured in a unique body with the plate.
8. Device according to any of the claims from 1 to 6, wherein said sleeves are manufactured as pieces separated from said plate



and are screwed into threaded holes obtained in the plate itself.







## INTERNATIONAL SEARCH REPORT

 Int. Application No.  
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**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 7 A61B17/74

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 674 222 A (BERGER ROGER ET AL) 7 October 1997 (1997-10-07)	1,2,7
Y	column 4, line 11 - line 24 figure 3	4-6
Y	FR 2 289 154 A (TORNIER RENE) 28 May 1976 (1976-05-28) page 1, line 38 - page 2, line 7 figure 2	4-6
A	US 2 081 293 A (DAVIS CHARLES D) 25 May 1937 (1937-05-25) column 1, line 41 - line 46 figures 3,4	4

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 1 093 696 A (POHL ERNST) 9 May 1955 (1955-05-09) page 3, paragraph 3 page 3, paragraph 6 figures 6,9 ---	3
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Information on patent family members

Int. I Application No

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